



EPA Region V

RAC

Response Action Contract



*Frontier Hard Chrome
Event 3 Long-Term Monitoring Report
(August 2004 Results)
Work Assignment Number: 230-RALR-1027*

EPA Contract: 68-W7-0026

December 2004

**FRONTIER HARD CHROME
LONG-TERM MONITORING REPORT
EVENT 3—AUGUST 2004
VANCOUVER, WASHINGTON**

Prepared for

**U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101**

Contract No. 68-W7-0026
Work Assignment No. 230-RALR-1027
Work Order No. 20064.230.100.0920
Document Control No. RFW230-2A-ARPU

December 2004

Prepared by

Weston Solutions, Inc.
190 Queen Anne Avenue North
Suite 200
Seattle, WA 98109

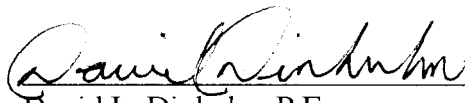
**FRONTIER HARD CHROME
LONG-TERM MONITORING REPORT
EVENT 3- AUGUST 2004
VANCOUVER, WASHINGTON**

Prepared for

U.S. EPA Contract No. 68-W7-0026
U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101

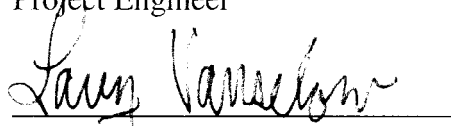
Document Control No. RFW230-2A-ARPU

Prepared
and
Approved By:


David L. Dinkuhn, P.E.
Project Engineer


Date: 21 DEC 2004

Prepared
and
Approved By:


Larry Vanselow, P.E.
Project Manager

Date: 20 DEC 2004

Prepared
and
Approved By:


Paul Swift, Ph.D.
Quality Assurance Manager

Date: 17 December 2004

TABLE OF CONTENTS

| <u>Section</u> | <u>Page</u> |
|--|-------------|
| 1. INTRODUCTION AND BACKGROUND..... | 1-1 |
| 1.1 INTRODUCTION | 1-1 |
| 1.2 BACKGROUND AND PROBLEM DEFINITION | 1-1 |
| 1.2.1 Site Background | 1-1 |
| 1.3 PLANNED MONITORING SCHEDULE..... | 1-2 |
| 2. SAMPLING ACTIVITIES AND RESULTS..... | 2-1 |
| 2.1 MONITORING WELL SAMPLING PROCEDURES | 2-1 |
| 2.2 ANALYTICAL RESULTS | 2-1 |
| 2.2.1 Chromium..... | 2-1 |
| 2.2.2 Water Quality | 2-2 |
| 2.3 GROUNDWATER FLOW DIRECTION AND ELEVATION | 2-2 |
| 2.4 QUALITY ASSURANCE..... | 2-3 |
| 2.5 INVESTIGATION-DERIVED WASTES | 2-3 |
| 2.6 DISCUSSION AND CONCLUSIONS | 2-3 |
| 3. ANALYTICAL METHODS AND DATA VALIDATION | 3-1 |
| 3.1 ANALYTICAL METHODS REQUIREMENTS AND DATA VALIDATION... | 3-1 |
| 4. REFERENCES | 4-1 |
| APPENDIX A GROUNDWATER CHROMIUM CONCENTRATION TREND | |
| APPENDIX B DATA VALIDATION MEMORANDUM | |

LIST OF FIGURES

| <u>Figure</u> | <u>Title</u> |
|---------------|---|
| 1 | Vicinity Map |
| 2 | Monitoring Well Locations |
| 3 | Chromium Concentrations in “A” Zone Groundwater |
| 4 | Chromium Concentrations in “B” Zone Groundwater |
| 5 | Groundwater Elevations |

LIST OF TABLES

| <u>Table</u> | <u>Title</u> |
|--------------|--|
| 1 | Sample Analyses Summary |
| 2 | Event 3 Monitoring Field Parameters |
| 3 | Comparison of 2004 Conventional Parameters |
| 4 | Groundwater Elevations |
| 5 | Quality Assurance Sample Results |

SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Long Term Monitoring Report has been prepared as directed by Task 9 “Project Performance” in the Scope of Work for Remedial Action for the Frontier Hard Chrome (FHC) Superfund Site (EPA 2003) located in Vancouver, Washington. This report describes the sampling activities performed and analytical results obtained during “Event 3” of the long-term groundwater monitoring program at the FHC site. Sampling activities for Event 3 were conducted during August 2004.

The FHC site was the subject of a remedial action conducted during the summer of 2003. The purpose of the remedial action (RA) was to treat the site’s chromium-contaminated soil and groundwater to cleanup levels specified in the Record of Decision. Long term monitoring is required to track offsite plume concentrations as well as show that the remedy is maintaining its operational functionality.

All Event 3 work was performed in accordance with project work plan titled *Frontier Hard Chrome, Long Term Monitoring Plan* (Weston 2004). No significant deviations from the work plan occurred.

This is the last monitoring event to be performed under this work assignment by Weston Solutions, Inc. (Weston). Responsibility for future groundwater monitoring associated with this site has been turned over to the Washington State Department of Ecology (Ecology).

1.2 BACKGROUND AND PROBLEM DEFINITION

1.2.1 Site Background

The FHC site is located in southeastern Vancouver, Washington (Figure 1). The facility address is 113 “Y” Street, Vancouver, Washington. The site is located in the Section 25, Township 2 north, Range 1 east, Willamette Meridian in Clark County, Washington. The location in latitude and longitude coordinates is 45 degrees, 37 minutes, 19 seconds north by 122 degrees, 38 minutes 45 seconds east (Degrees, Minutes, Seconds [DMS]). The site was previously occupied by several metals fabricating businesses and was used for storage and as a staging area for a neighboring business. Currently, no buildings exist on the site and the site is vacant.

The FHC site proper covers approximately 0.5 acre and is bordered to the east by Grand Avenue, to the south by Cassidy Manufacturing, and to the west by “Y” Street.

Work began on the remedial design in October 2001. The remedial design was completed in February 2003. The remedial action, consisting of building demolition, treatment of source area

soil and groundwater, and installation of an in-situ redox manipulation (ISRM) treatment wall (to treat hexavalent chromium), was completed in September 2003.

1.2.2 Problem Definition

The goal of the remedial action was to treat source area soil and groundwater to reduce hexavalent chromium concentrations such that groundwater downgradient of the site would attenuate to chromium concentrations less than 50 micrograms per liter (ug/L). To demonstrate this, groundwater quality was monitored in two areas. The first area consisted of locations immediately within and down gradient of the ISRM wall. Wells located within and just down gradient of the wall were monitored to ensure the continued operational functionality of the ISRM Treatment Wall. The second area monitored consisted of the historical chromium contaminated groundwater plume located down gradient of the ISRM wall. This down gradient plume did not receive treatment during the remedial action and was monitored to track the long-term expected reduction in chromium concentration as a result of completing the remedial action and elimination of the source of hexavalent chromium.

Long-term groundwater monitoring is required by the site's Record of Decision.

1.3 PLANNED MONITORING SCHEDULE

Planned sampling events were to be conducted approximately quarterly for first year. Planned sampling events were scheduled for February, April, August and December 2004. The first three sampling events in 2004 were completed by Weston for EPA on the established schedule. The sampling event performed the week of 16 August 2004 concluded monitoring for approximately one year after the remedial action was completed.

In September/October 2004, monitoring of the FHC site was turned over to the Washington State Department of Ecology.

SECTION 2

SAMPLING ACTIVITIES AND RESULTS

2.1 MONITORING WELL SAMPLING PROCEDURES

Sampling activities for Event 3 were conducted on August 16 through August 19, 2004 by EPA's Environmental Services Assistance Team (ESAT) with oversight by Weston Solutions, Inc, (Weston). During this period, representatives from Ecology toured the site and were shown where the monitoring wells were located. Discussions were held with Ecology regarding specific monitoring well procedures and anomalies.

The monitoring wells in the vicinity of the FHC site are shown on Figure 2. A total of 33 wells in the vicinity of the site were sampled for metals in accordance with the *Long Term Monitoring Plan* (Weston 2004).

Well purging and sampling were performed according to EPA sampling guidelines and Weston standard operating procedures. The wells were sampled with a peristaltic pump equipped with new polyethylene tubing deployed to mid-screen depth at each well. The wells were purged prior to sampling until monitored field parameters (turbidity, conductivity, pH, dissolved oxygen, ORP, and temperature) stabilized. The field parameter readings were recorded on field sampling forms.

Groundwater samples were analyzed for total analytes list (TAL) metals. In cases where groundwater turbidity was greater than 10 nephelometric turbidity units, samples were passed through a 0.45-micron filter in the field and submitted for dissolved TAL metals. Selected samples were analyzed for total sulfur and sulfate to provide an assessment of the distribution of byproducts from the reducing agent used during ISRM wall installation.

Groundwater constituents are provided in Table 1. Measured field parameters are provided in Table 2.

2.2 ANALYTICAL RESULTS

2.2.1 Chromium

Chromium was detected in 30 of the 33 wells sampled. Chromium concentrations in the "A" zone ranged from a maximum concentration of 24.9 ug/L in well RA-MW-12A (located within the ISRM treatment wall) to a low of 1.3 ug/L in well RA-MW-13A (also located within the ISRM treatment wall). Monitoring well RA-MW-12A has generally had the highest concentrations of chromium. Dissolved concentrations of chromium in well RA-MW-12A decreased from 56 ug/L in the previous April 2004 sample to 24.9 ug/L in this latest round of sampling. Overall, chromium in well RA-MW-12A has decreased from 192 ug/L (October 2003) to the current concentration of 24.9 ug/L. "A" zone chromium concentrations and plume contours are shown in Figure 3.

Chromium concentrations in “B” zone groundwater were similar to those in “A” zone groundwater. Chromium concentrations in “B” zone groundwater ranged from 8 ug/L downgradient of the site (well W85-7B) to a low of 0.79 ug/L immediately west of the Cassidy Building (well W92-16B). “B” zone chromium concentrations and plume contours are shown in Figure 4.

Figures showing the chromium concentration trends in groundwater over time are included in Appendix A. Data from wells sampled during Operational and Functional monitoring in November and December 2003 are included in these figures where available to assist in determining trends.

Figures 3, 4, and those in Appendix A used dissolved chromium values where turbidity exceeded 10 NTU. In this latest August 2004 round of sampling, turbidity exceeded 10 NTU for wells RA-MW-11B, RA-MW-12A, B87-8 and W98-20A.

2.2.2 Water Quality

Dissolved oxygen (DO) concentrations ranged from a low of 0.2 mg/L to a high of 6.54 mg/L. DO averaged 1.31 mg/L in samples collected within the ISRM Treatment Wall. The concentration of DO in this latest round of sampling is moderately greater than in the previous rounds of sampling. The current concentration of DO still indicates the wall is reductive which is necessary for treatment of hexavalent chromium. Samples of groundwater collected downgradient of the ISRM Treatment Wall had the highest concentrations of DO which tended to increase with distance from the wall.

pH ranged from 6.2 to 8.9. The highest pH was located within the treatment zone; this trend is consistent with the high pH of the reagent used to create the ISRM Treatment Wall.

The highest sulfur and sulfate concentrations were located within the treatment wall. Maximum sulfur and sulfate concentrations in groundwater were 324 mg/L and 1056 mg/L, respectively. Concentrations of sulfur and sulfate were significantly lower immediately downgradient of the wall.

2.3 GROUNDWATER FLOW DIRECTION AND ELEVATION

Groundwater surface elevations were determined using the known elevation of the top of each well casing and the depth to groundwater measured in each long term monitoring well. The depth to groundwater measurements were collected during a single afternoon on the second day of the sampling event by the Weston field leader. Attempts were made to obtain the elevation of the Columbia River at the United State Geological Survey (USGS) gauging station 14144700 located at the nearby I-5 bridge for use in determining flow direction. The river elevation information can usually be obtained from <http://waterdata.usgs.gov/wa/nwis/>.

However, no information on river height was available for 17 August 2004. Therefore, groundwater elevation could not be compared to stage height of the Columbia River during the

period groundwater elevations were recorded (17 August 2004).

Groundwater surface elevations for each well measured are shown in Table 4.

The groundwater flow direction, as determined using groundwater surface elevations measured just prior to sampling, is heading to the northeast towards the FHC site. Groundwater elevation and gradient information is graphically shown in Figure 5.

A horizontal gradient was calculated for 17 August 2004 with a result of 0.000085 ft/ft with a flow direction from the Columbia River towards the FHC site. The groundwater table during this period was nearly flat with a drop in elevation of 0.22 feet over a distance of 2,600 feet.

2.4 QUALITY ASSURANCE

Data quality was confirmed by running several laboratory and field duplicate samples. Table 5 shows the results from laboratory and field duplicate samples.

Duplicate results had good correlation to the original sample results.

2.5 INVESTIGATION-DERIVED WASTES

Investigation-derived waste (IDW) generated during the sampling event consisted of well purge water, used PPE, and disposable sampling supplies. During sampling, purge water was stored on site in 5-gallon buckets. At the completion of sampling, the water was transported to the City of Vancouver's operations center and disposed of in accordance with the disposal permit issued to Weston by the city. Personnel protective equipment and other solid wastes were disposed of in a dumpster.

2.6 DISCUSSION AND CONCLUSIONS

Chromium concentrations in onsite "A" zone groundwater were generally less than 10 ug/L. Chromium concentrations in downgradient "A" zone groundwater were also less than 10 ug/L. In general, the chromium concentrations in groundwater on and downgradient of the site were relatively uniform during the August 2004 sampling event.

Overall, groundwater chromium concentrations have decreased since February 2004 in 25 out of 33 wells.

The deeper "B" zone groundwater downgradient of the site contained chromium in concentrations similar to that in the "A" zone. Chromium concentrations in "B" zone groundwater downgradient of the site were also less than 10 ug/L.

Dissolved oxygen data collected from within the ISRM Treatment Wall indicates that an area of reducing conditions still exists implying the hexavalent chromium treatment zone is still active.

Dissolved oxygen levels in groundwater within the treatment wall have typically increased by a factor of 2 since February 2004. However, most locations still contain dissolved oxygen at concentrations less than 2 mg/L implying reducing conditions are present.

Sulfur/sulfate concentrations within the ISRM Treatment Wall have fluctuated while sulfur/sulfate concentrations downgradient of the ISRM Treatment Wall have increased since February 2004. Sulfur/sulfate concentrations in wells B87-8 and B85-4 located across East 1st Street (downgradient of the site) have increased by a factor of approximately 2 to 3 since February 2004. This increase indicates that the treatment reagents are migrating in a southerly direction with the overall net groundwater flow direction. Sulfur and sulfate concentrations were less than 325 mg/L and 1,060 mg/L in all locations sampled during August.

SECTION 3

ANALYTICAL METHODS AND DATA VALIDATION

3.1 ANALYTICAL METHODS REQUIREMENTS AND DATA VALIDATION

Analyses of samples collected during the field event were performed by an EPA CLP laboratory. The Event 3 samples were analyzed by Sentinel, Inc., in Huntsville, Alabama.

Data was validated by EPAs CADRE program and reviewed by Weston. A data validation memorandum prepared by Weston is provided in Appendix B.

The laboratory data quality assurance review of 40 water samples was completed. Samples were collected 08/16/2004 – 08/19/2004 from the Frontier Hard Chrome site Long-Term Monitoring project. Samples were analyzed for Target Analyte List (TAL) metals.

The quality assurance review was performed on the CLP laboratory Form I data sheets and EPA memoranda to ensure that the analytical results met data quality objectives for the project. All laboratory quality assurance results as applicable (e.g., holding times, blank sample analysis, matrix spike/duplicate analysis, laboratory control sample analysis) supplied to Weston for the analyses met acceptance criteria specified in the work plan (Weston 2004), with the following exceptions:

- Aluminum, arsenic, cadmium, iron, lead, manganese, selenium, selenium, and thallium were detected in one or more calibration blank samples. Associated, detected analyte results were qualified as non-detected (U) at an elevated reporting limit – up to ten-times the concentration of the associated blank sample result.
- Potassium and zinc exceeded the control criteria in one or more serial dilution samples. Detected potassium and zinc results were qualified as estimated (J); non-detected potassium and zinc results were qualified as non-detected, estimated concentration (UJ).

All affected data were qualified appropriately. No other QA/QC exceptions were noted in the data review. These exceedances did not adversely affect the project DQOs.

SECTION 4

REFERENCES

EPA (United States Environmental Protection Agency), 2003. Statement of Work for Long Term Response Action. Frontier Hard Chrome, Vancouver, WA. December 30th, 2003.

Weston (Weston Solutions, Inc.), 2004. Frontier Hard Chrome Long Term Monitoring Plan. Prepared for the U.S. Environmental Protection Agency, Region 10, Seattle, Washington. February.